

JAPAN

EDICT OF GOVERNMENT

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JIS B 9713-3 (2004) (English): Safety of
machinery -- Permanent means of access to
machinery -- Part 3: Stairs, stepladders and
guard-rails

ISO INSIDE

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*The citizens of a nation must
honor the laws of the land.*

Fukuzawa Yukichi

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JAPANESE
INDUSTRIAL
STANDARD

Translated and Published by
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JIS B 9713-3 : 2004

(ISO 14122-3 : 2001)

(JMF)

**Safety of machinery—Permanent
means of access to machinery—
Part 3 : Stairs, stepladders and
guard-rails**

ICS 13.110

Reference number : JIS B 9713-3 : 2004 (E)

Foreword

This translation has been made based on the original Japanese Industrial Standard established by the Minister of Health, Labour and Welfare and the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee according to the proposal of establishing a Japanese Industrial Standard from The Japan Machinery Federation (JMF)/the Japanese Standards Association (JSA), with a draft of Industrial Standard based on the provision of Article 12 Clause 1 of the Industrial Standardization Law.

This Standard has been made based on ISO 14122-3:2001 *Safety of machinery—Permanent means of access to machinery—Part 3 : Stairs, stepladders and guard-rails* for the purposes of making it easier to compare this Standard with International Standard; to prepare Japanese Industrial Standard conforming with International Standard ; and to propose a draft of an International Standard which is based on Japanese Industrial Standard.

Attention is drawn to the possibility that some parts of this Standard may conflict with a patent right, application for a patent after opening to the public, utility model right or application for registration of utility model after opening to the public which have technical properties. The relevant Ministers and the Japanese Industrial Standards Committee are not responsible for identifying the patent right, application for a patent after opening to the public, utility model right or application for registration of utility model after opening to the public which have the said technical properties.

JIS B 9713 consists of the following parts, under the general title "*Safety of machinery—Permanent means of access to machinery*":

- Part 1 : Choice of fixed means of access between two levels*
- Part 2 : Working platforms and walkways*
- Part 3 : Stairs, stepladders and guard-rails*
- Part 4 : Fixed ladders.*

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In the event of any doubts arising as to the contents,
the original JIS is to be the final authority.

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Safety of machinery—Permanent means of access to machinery— Part 3 : Stairs, stepladders and guard-rails

Introduction This Japanese Industrial Standard has been prepared based on the first edition of ISO 14122-3:2001 *Safety of machinery—Permanent means of access to machinery—Part 3 : Stairs, stepladders and guard-rails* published in 2001 without modifying the technical contents.

The foreword of the original International Standard has been excluded because it is not part of the provisions.

This part of JIS B 9713 is a group safety standard and Part 3 of the series of standards in JIS B 9713.

The provisions of this document may be supplemented or modified by a product safety standard.

- Notes 1 For machines which are covered by the scope of a product safety standard and which have been designed and built according to the provisions of that standard, the provisions of that product safety standard take precedence over the provisions of this group safety standard.
- 2 This Standard requires the manufacturers to provide “safe access to operating position, servicing points and maintenance area” and to prevent “risk of slipping, tripping or falling”
- 3 See also relevant matters described in 6.2.4 “*Provision for safe access to machinery*” of ISO 12100-2.
- 4 The use of materials other than metals (wood composite materials, so-called advanced materials, etc.) does not alter the application of this part of JIS B 9713.

Information : JIS Z 8051:2004 sets up the “hierarchy” of safety standards as follows:

- *basic safety standard*, comprising fundamental concepts, principles and requirements with regard to general safety aspects applicable to a wide range of products, processes and services;
- *group safety standard*, comprising safety aspects applicable to several or a family of similar products, processes or services dealt with by more than one committee, making reference, as far as possible, to basic safety standards;
- *product safety standard*, comprising safety aspect(s) for a specific, or a family of product(s), process(es) or service(s) within the scope of a single committee, making reference, as far as possible, to basic safety standards and group safety standards;

The purpose of this Standard is to define the general requirements for safe access to machines mentioned in ISO 12100-2. Part 1 of JIS B 9713 gives advice about the correct choice of access means when the necessary access to the machine is not possible directly from the ground level or from a floor.

Information : The dimensions specified are consistent with established ergonomic data given in EN 574-3 "*Safety of machinery—Human body dimensions—Part 3: Anthropometric data*".

1 Scope This Standard applies to all machinery (stationary and mobile) where fixed means of access are necessary.

This Standard applies to stairs, step ladders and guard-rails which are a part of a machine.

This Standard may also apply to stairs, step ladders and guard-rails to that part of the building where the machine is installed, providing the main function of that part of the building is to provide a means of access to the machine.

Notes 1 This Standard may be used also for means of access which are outside the scope of this Standard. In those cases the possible relevant national or other regulations should take precedence.

This Standard applies also to stairs, step ladders and guard-rails specific to the machine which are not permanently fixed to the machine and which may be removed or moved to the side for some operations of the machine (e.g. changing tools in a large press).

For the significant hazards covered by this Standard, see clause 4 of JIS B 9713-1.

2 The International Standard corresponding to this Standard is as follows.

In addition, symbols which denote the degree of correspondence in the contents between the relevant International Standard and JIS are IDT (identical), MOD (modified), and NEQ (not equivalent) according to ISO/IEC Guide 21.

ISO 14122-3:2001 *Safety of machinery—Permanent means of access to machinery—Part 3: Stairs, stepladders and guard-rails* (IDT)

2 Normative reference The following standard contains provisions which, through reference in this Standard, constitute provisions of this Standard. If the indication of the year of publication is given to these referred standard, only the edition of the indicated year constitutes the provision of this Standard but the revision and amendment made thereafter do not apply. The normative reference without the indication of the year of coming into effect apply only to the most recent edition (including amendments).

JIS B 9713-1 *Safety of machinery—Permanent means of access to machinery—Part 1: Choice of fixed means of access between two levels*

Note : ISO 14122-1:2001 *Safety of machinery—Permanent means of access to machinery—Part 1: Choice of fixed means of access between two levels* is identical with the said standard.

3 Terms and definitions For the purposes of this part of JIS B 9713, the terms and definitions stated in JIS B 9713-3 and the following additional definitions apply:

Information : See EN 1070 for relevant terms and definitions.

3.1 stairs and step ladders the definitions stated in 3.2 and 3.3 of JIS B 9713-1 are completed by:

Succession of horizontal levels (steps or landings) allowing passage on foot from one level to another composed of the following elements, shown in figure 1 and explained from 3.1.1 to 3.1.16.

3.1.1 climbing height vertical distance between the reference level and the landing (H in figure 1)

3.1.2 flight uninterrupted sequence of steps between two landings

3.1.3 going horizontal distance between the step nosing of two consecutive steps (g in figure 1)

3.1.4 headroom minimum vertical distance, clear of all obstacles (such as beams, ducts, etc.) above the pitch line (e in figure 1)

3.1.5 landing horizontal resting area situated at the end of a flight (l in figure 1).

3.1.6 walking line theoretical line indicating the average path of the users of the stair or the step ladder

3.1.7 overlap difference between the depth of the step and the going (r in figure 1)

3.1.8 pitch line a notional line connecting the leading edge of the nosing of successive steps taken on the walking line and which extends down to the landing at the bottom of the flight from the nosing on the landing at the top of the flight (p in figure 1)

3.1.9 angle of pitch angle between the pitch line and the reference level (α in figure 1)

3.1.10 rise height between two consecutive steps measured from the tread surface of one to the tread surface of the next (h in figure 1)

3.1.11 step horizontal surface on which one places the foot to go up or down the stair or step ladder

3.1.12 nosing top edge at the front of the step or landing

3.1.13 string flanking framework element supporting the steps

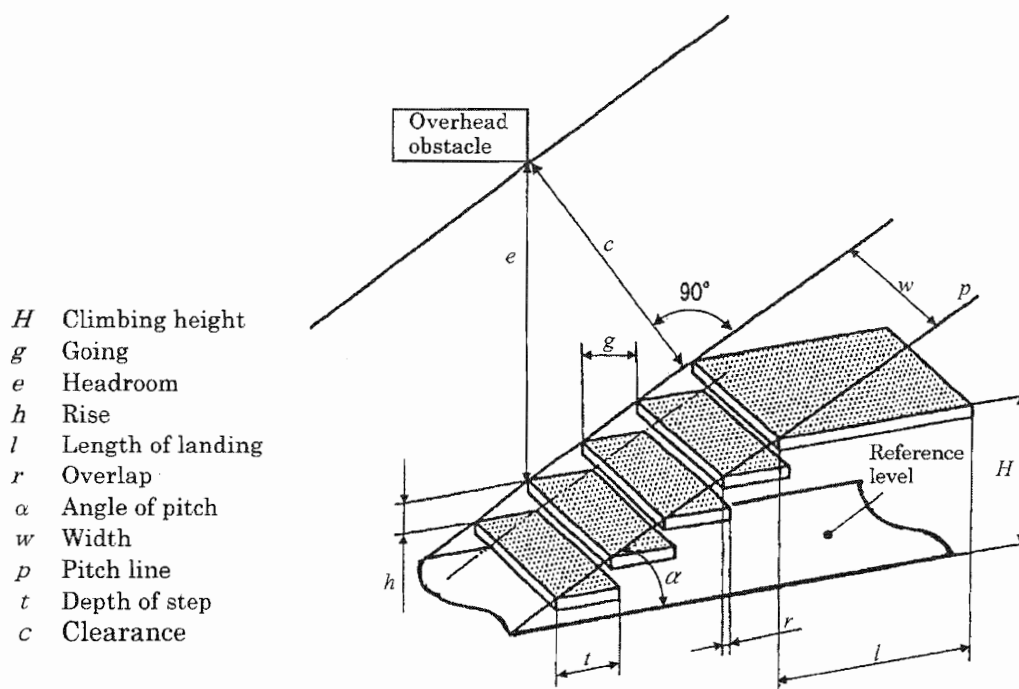


Figure 1 Parts of stairs and step ladders

3.1.14 width clear distance over the outside faces of the step (w in figure 1)

3.1.15 depth of step clear distance from the leading edge or the nosing to the rear of the step (t in figure 1)

3.1.16 clearance absolute minimum clear distance between any overhead obstacle and the pitch line (c in figure 1) measured at an angle of 90° from the pitch line

3.2 guard-rail device for protection against accidental fall or accidental access to a hazardous area, with which stairs, step ladders or landings, platforms and walkways may be equipped. Typical parts of a guard-rail are shown in figure 2 and defined in 3.2.1 to 3.2.5.

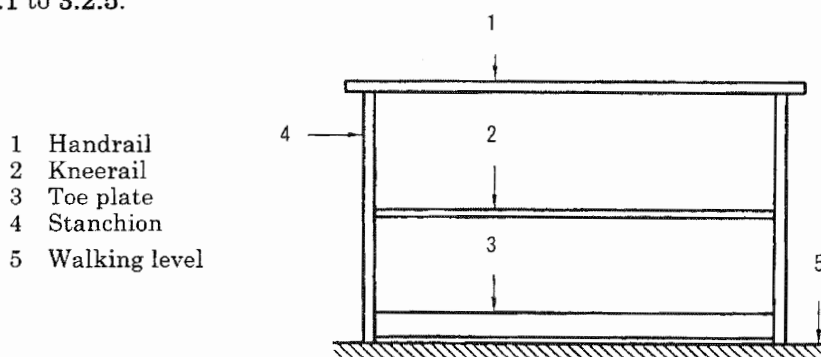


Figure 2 Example of the parts of a typical structure of a guard-rail

3.2.1 handrail top element designed to be grasped by the hand for body support which can be used individually or as the upper part of a guard-rail (1 in figure 2)

3.2.2 kneerail element of the guard-rail placed parallel with the handrail, giving extra protection against the passage of a body (2 in figure 2)

3.2.3 stanchion vertical structural element of the guard-rail to anchor the guard-rail to the platform or stair (4 in figure 2)

3.2.4 toe-plate solid lower part of a guard-rail or upstand on a landing to prevent the fall of objects from a floor level (3 in figure 2)

Note : A toe-plate also reduces the free space between the floor and kneerail to prevent the passage of a body.

3.2.5 self closing gate part of the guard-rail which is intended to be opened easily. When the gate is released, it will close automatically using e.g. the effect of gravity or a spring

4 General safety requirements concerning materials and dimensions

4.1 The materials and dimensions of constituent elements and construction mode used shall meet the safety objectives of this Standard.

4.2 The materials used shall be, themselves, by their nature or by a complementary treatment, able to resist corrosion provoked by the surrounding atmosphere.

4.3 Any parts liable to be in contact with the users shall be designed so as not to hurt or hinder (sharp corners, welds with burrs, rough edges, etc.).

4.4 Steps and landings shall offer satisfactory slip resistance to avoid any risk of slipping.

4.5 Opening or closing of moving parts (gates) shall not cause further hazards (for example by shearing or by falling) to users and other persons in the vicinity.

4.6 Fittings, hinges, anchorage points, supports and mountings shall provide sufficient rigidity and stability to the assembly to ensure safety.

4.7 The structure and the steps shall be designed to satisfactorily resist the intended imposed loads.

4.7.1 For the structure the unfactored loads used in the industrial field, may vary from 1.5 kN/m² for low density pedestrian traffic without load, up to 5 kN/m² for low density pedestrian traffic with load or for high density pedestrian traffic.

4.7.2 Steps shall resist the following unfactored loadings:

- if the width $w < 1\,200$ mm, then 1.5 kN shall be distributed over an area of 100 mm \times 100 mm where one boundary is the leading edge of the nosing applied at the middle of the stair width;
- if the width $w \geq 1\,200$ mm, then respectively 1,5 kN shall be distributed simultaneously over each of the 100 mm \times 100 mm areas applied at the most unfavourable

points spaced at intervals of 600 mm where one boundary is the leading edge of the nosing.

The deflection between the structure and the steps under an unfactored load shall not exceed $1/300^{\text{th}}$ of the span or 6 mm whichever is the lesser.

5 Safety requirements applicable to stairs

5.1 Going, g , and rise, h , shall meet the formula(1):

$$600 \leq g + 2h \leq 660 \text{ (dimensions in mm)} \quad \dots\dots\dots (1)$$

5.2 The overlap, r of the step shall be ≥ 10 mm and shall apply equally to landings and floors.

5.3 On the same flight, the rise shall be constant wherever possible. In the case where it is not possible to maintain the height of the rise between the level of departure and the lower step, it may be reduced by a maximum of 15 %. If it is justified, it may be increased, for example in the case of certain mobile machines.

5.4 The uppermost step shall be level with the landing (see figure 3).

Note : The principle of maintaining the going at the top the stair is important and a change of going at the landing which is the last step is a significant cause of accidents.

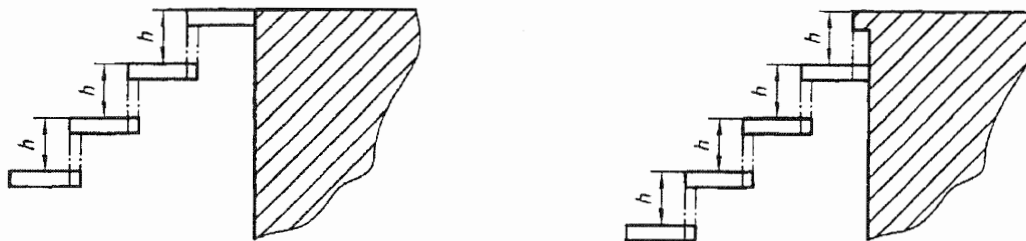


Figure 3 Positioning of the uppermost step

5.5 Headroom, e , shall be 2 300 mm minimum.

5.6 Clearance, c , shall be 1 900 mm minimum.

5.7 Unless there are exceptional circumstances, the clear width of a stair shall be a minimum of 600 mm but preferably 800 mm. When the stairway is usually subject to the passage or crossing of several persons simultaneously, the width shall be increased to 1 000 mm. The width of the stair, when designated as an escape way shall meet the requirements of appropriate regulations.

Note : When justified by the risk assessment and restrictions due to the machinery or environment, the free width may be reduced to no less than 500 mm if:

— the working platform or stair is used only occasionally, and;

— the reduction is made only for a short distance.

5.8 The climbing height H of individual flights shall not exceed 3 000 mm, otherwise a landing is deemed necessary before continuing on to another flight. The length of the landing, l , shall be at least 800 mm and in any case equal to or greater than the width of the stair. Only in the case of a single flight (see 3.1.2) shall the climbing height not exceed 4 000 mm.

5.9 For requirements related to guard-rails for stairs, see 7.2.

6 Safety requirements applicable to step ladders

6.1 The minimum step depth, t , shall be 80 mm.

6.2 The maximum rise, h , shall be 250 mm.

6.3 The overlap, r , of the step or the landing shall be ≥ 10 mm.

6.4 The clear width between stringers or guard-rails shall be within the range of 450 mm to 800 mm but preferably 600 mm.

6.5 On the single flight, the rise shall be constant wherever possible. In the case where it is not possible to maintain the height of the rise between the level of departure and the first step, it may be reduced by a maximum of 15 %. If it is justified, it may be increased, for example in the case of certain mobile machines.

6.6 Headroom, e , shall be 2 300 mm minimum.

6.7 Clearance, c , shall be 850 mm minimum.

6.8 The climbing height, H , of a single flight shall not exceed 3 000 mm.

Note : For multi-flights, additional safety measures should be considered.

7 Safety requirements applicable to guard-rails

7.1 Horizontal guard-rails

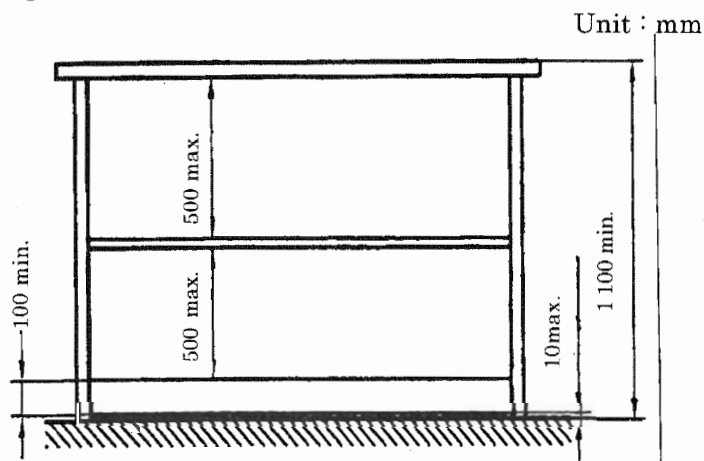


Figure 4 Example of a horizontal guard-rail

7.1.1 A guard-rail shall be installed near to the dangerous areas where there is a risk of sinking or of passage through (for example, walkway accesses to an extractor on a roof).

7.1.2 When the height of the possible fall exceeds 500 mm, a guard-rail shall be installed.

7.1.3 A guard-rail shall be provided when the gap between a platform and the structure of a machine or wall is greater than 200 mm or if the protection of the structure is not equivalent to a guard-rail. However, a toe plate shall be provided when the gap between the platform and adjoining structure is greater than 30 mm.

7.1.4 The minimum height of the guard-rail shall be 1 100 mm.

7.1.5 The guard-rail shall include at least one intermediate kneerail or any other equivalent protection. The clear space between the handrail and the kneerail, as well as between the kneerail and the toe-plate, shall not exceed 500 mm.

7.1.6 When vertical uprights are used instead of a kneerail the clear horizontal distance between those uprights shall be 180 mm maximum.

7.1.7 A toe-plate with a minimum upstand of 100 mm shall be placed 10 mm maximum from the walking level and the edge of the platform (see figure 4).

7.1.8 The distance between the axes of the stanchions is preferred to be limited to 1 500 mm. But, if this distance is exceeded, specific attention shall be paid to the stanchion anchoring strength and the fixing devices.

7.1.9 In the case of an interrupted handrail, to prevent hand traps the clear space between the two segments should not be less than 75 mm and not greater than 120 mm (see figure 5). If there is a larger opening, a self closing gate shall be used.

Unit : mm

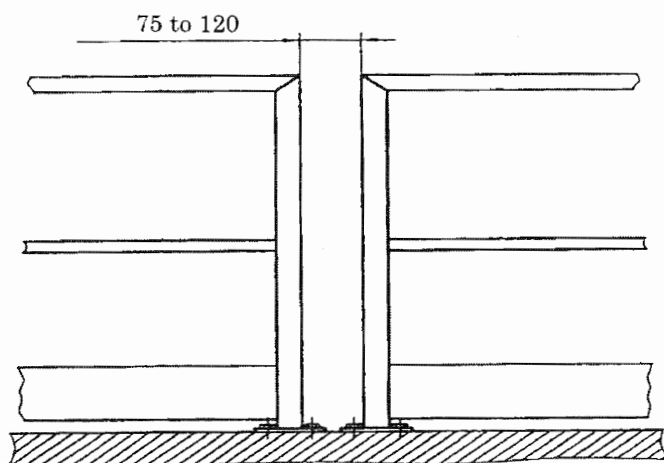


Figure 5 Clear space between two guard-rail segments

7.1.10 Where access through the guard-rail is required, a self-closing gate shall be used. A gate shall have the handrail and kneerail positioned at the same level as that of the guard-rail that it extends to (for exit section of the ladder, see JIS B 9713-4).

Any gates shall be self-closing and shall be designed to open onto the platform or floor and to close against a firm stop to prevent users pushing against them and falling through the opening. Gates shall be subject to the same loading criteria as guard-rails.

7.1.11 The ends of the handrail shall be designed in such a manner as to eliminate any risk of harm caused by sharp edges of the product or by catching of the user's clothing.

7.2 Guard-rails of stairs and step ladders

7.2.1 A stair shall have at least one handrail. If the stair width is greater or equal to 1 200 mm, there shall be two handrails. Step ladders shall always have two handrails.

7.2.2 A guard-rail shall be fitted whenever the height to climb is greater or equal to 500 mm, and when there is a lateral space adjacent to the string which is greater or equal to 200 mm, in order to provide protection on the side of the stair where this gap exists.

7.2.3 The vertical height of the handrail on a stair shall be between 900 mm and 1 000 mm above the nosing on the step of the flight and be a minimum of 1 100 mm above the walking level on the landing. The shape of the handrail should have a diameter between 25 mm to 50 mm or an equivalent section, to provide a good grip for the hand.

Unit : mm

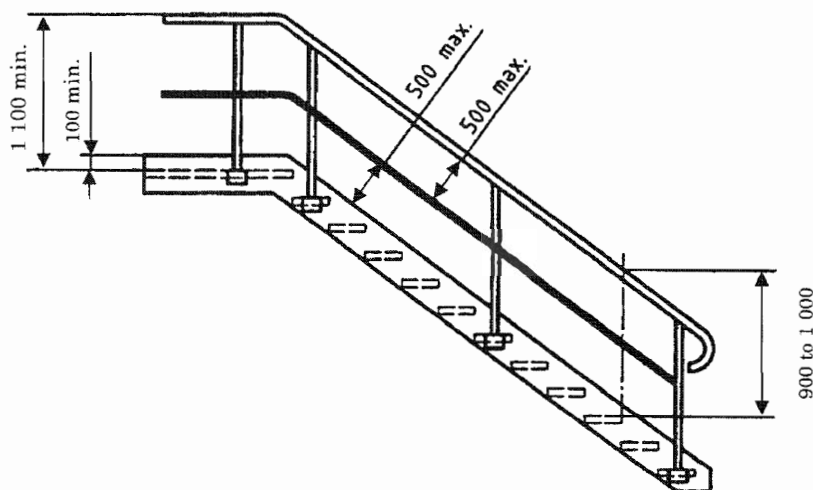


Figure 6 Example of a stair guard-rail and its continuation to the horizontal guard-rail

7.2.4 The distance (dimension X) from the pitchline on a step ladder to the centreline of the handrail should be as shown in figure 7, with the handrail commencing from at least the distance of 1 000 mm measured vertically from the bottom of the ladder. Table 1 gives indicative dimensions.

Unit : mm

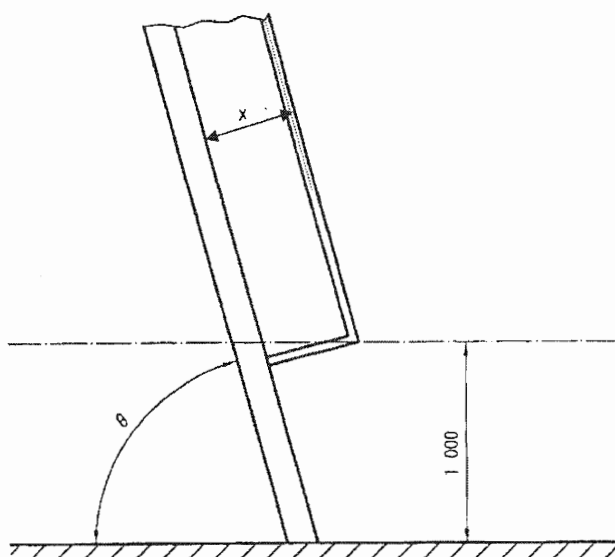


Figure 7 Positioning of a handrail on a step ladder

Table 1 Example of distances from the pitchline on a step ladder to the centreline of the handrail

θ (°)	X (mm)
60	250
65	200
70	150
75	100

7.2.5 The guard-rail on a stair shall include at least a kneerail or any equivalent device. The clear space between the handrail and the kneerail, as well as between the kneerail and the string, shall not exceed 500 mm (see figure 6).

Unit : mm

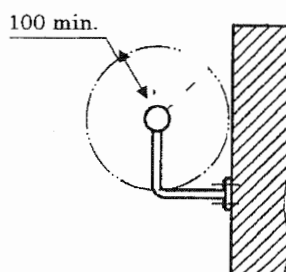


Figure 8 Minimum gap between the handrail and any obstacle

7.2.6 The length of the handrail shall be clear of obstacles within a distance of 100 mm, except on the underside of the handrail, for the mounting of stanchion supports (see figure 8).

7.3 Structural requirements The guard-rail shall support, without any perceivable permanent deformation, an unfactored horizontally applied point load equal to the service load, applied first to the top of the stanchion, then at the least favourable point along the handrail. In both cases, the maximum loaded deflection shall not exceed 30 mm.

The minimum service load shall be calculated by the following formula:

$$F_{\min} = 300 L$$

where, F_{\min} : minimum service load (Unit : N)

L : maximum distance [between the axes of two successive stanchions (see figure 9), unit : m]

Notes 1 F_{\min} should be increased according to the conditions of use without exceeding the above required deflection value.

2 It is essential to test the strength of the guard-rail under factored loads should it be required to verify the absence of any perceivable permanent deformation.

8 Verification of safety requirements

8.1 General The safety requirements of this Standard may be verified by measurements, inspection, calculation and/or testing. When testing is chosen, the testing procedure described in this clause shall be used.

8.2 Testing of guard-rails An unfactored load F is applied to the handrail horizontally, progressively and without shock, at the height of 1 100 mm.

The deflections (f_1, f_2) are taken along the centre line by deflection gauges positioned horizontally as shown in figure 9.

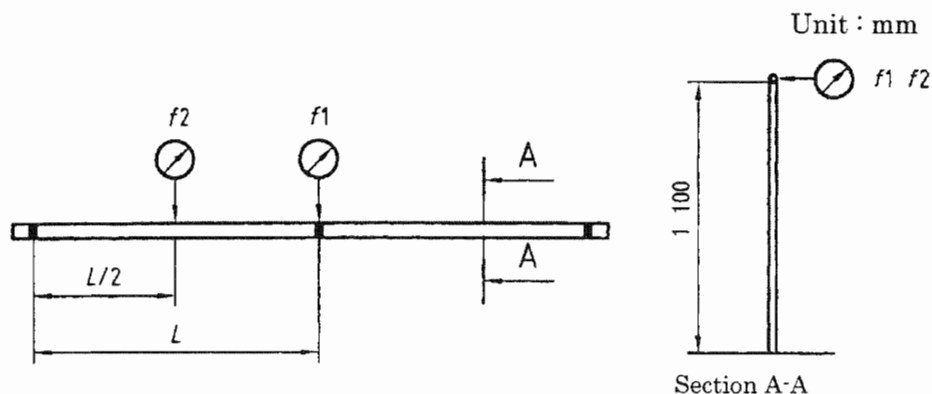


Figure 9 Position of the deflection gauges

8.2.1 Preloading An unfactored load of $0.25 F$ is applied to the guard-rail as shown in figure 10 for 1 minute perpendicular to a stanchion then the guard-rail is unloaded and the dials are reset to zero.

8.2.2 Stanchion measurement An unfactored load F is applied as shown in figure 10 for 1 minute.

The deflection $f1$ measured during the loading shall not exceed 30 mm.

There shall be no perceivable permanent deformation, after unloading the service load.

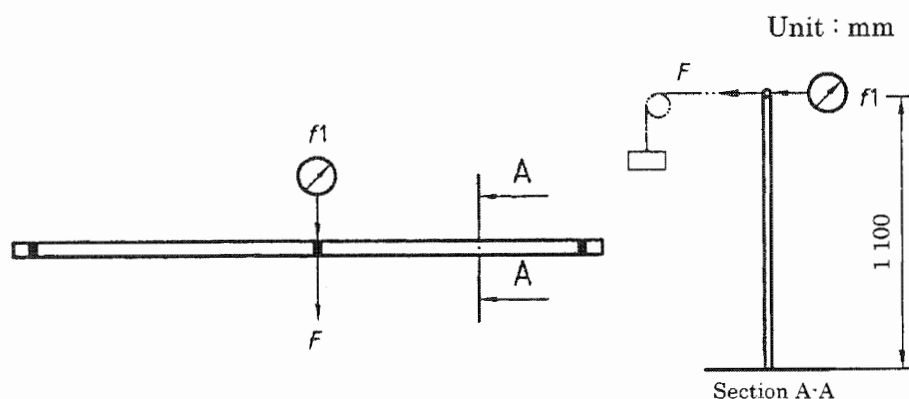


Figure 10 Stanchion measurement

8.2.3 Handrail measurement An unfactored load F is applied as shown in figure 11.

The measured deflection $f2$ during the loading shall not exceed 30 mm.

There shall be no perceivable permanent deformation, after unloading.

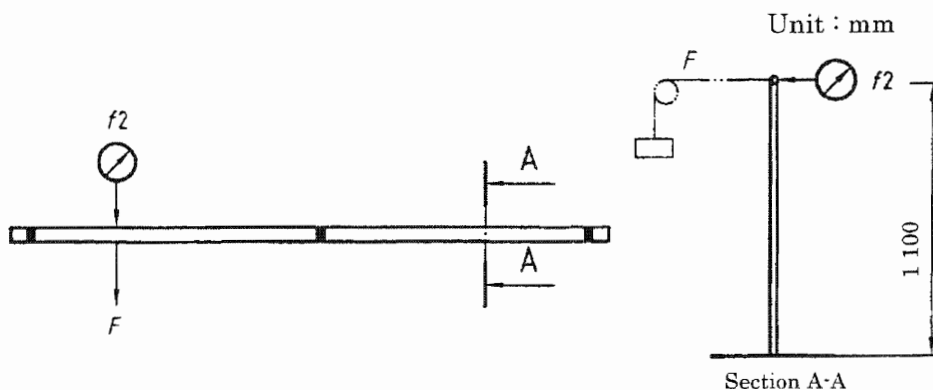


Figure 11 Handrail measurement

9 Assembly instructions All information on the correct assembly shall be contained in the assembly instructions. In particular, information on the method of fixing shall be included.

10 Information for use—Instruction handbook The instruction handbook of the machinery shall state clearly what are the access means provided by the manufacturer of the machinery according to 5.5.1 c of ISO 12100-2.

Annex A (informative) Bibliography

This annex is to supplement the matters related to the text and not to constitute the provisions of this Standard.

In compiling this Standard the following have been taken into account:

- JIS B 9702 *Safety of machinery—Principles of risk assessment*
- JIS B 9707 *Safety of machinery—Safety distances to prevent danger zones being reached by the upper limbs*
- JIS B 9708 *Safety of machinery—Safety distances to prevent danger zones being reached by the lower limbs*
- JIS B 9711 *Safety of machinery—Minimum gaps to avoid crushing of parts of the human body*
- JIS B 9713-2 *Safety of machinery—Permanent means of access to machinery—Working platforms and walkways*
- JIS B 9713-4 *Safety of machinery—Permanent means of access to machinery—Fired ladders*
- ISO 12100-1 *Safety of machinery—Basic concepts, general principles for design—Part 1: Basic terminology, methodology*
- ISO 12100-2 *Safety of machinery—Basic concepts, general principles for design—Part 2: Technical principles*
- EN 131-2 *Ladders—Requirements, Tests, Markings*
- EN 353-1 *Personal protective equipment against falls from a height—Guided type fall arresters on a rigid anchorage line*
- EN 364 *Personal protective equipment against falls from a height—Test methods*
- EN 547-1 *Safety of machinery—human body dimensions—Part 1: Principle for determining the dimensions required for openings for whole body across into machinery*
- EN 547-2 *Safety of machinery—human body dimensions—Part 2: Principle for determining the dimensions required for access openings*
- EN 547-3 *Safety of machinery—human body dimensions—Part 3: Anthropometric data*
- EN 795 *Protection against falls from a height—Anchorage devices—Requirements and testing*
- EN 1070 *Safety of machinery—Terminology*

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